

DETAILED ACTION

Comments

1. Applicant's request for reconsideration of the finality of the rejection of the last Office action is persuasive and, therefore, the finality of that action is withdrawn (See Reply to Final Office Action filed on March 25, 2008).

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1-7, 11-14 and 16 are rejected under 35 U.S.C. 102(b) as being anticipated by Hayton et al. ("Analysis of dynamic MR breast images using a model of contrast enhancement", Medical Image Analysis, Vol. 1, No. 3, pp.207-224).

Re claims 1, 14 and 16: Hayton et al. disclose a method/computer readable medium/image processing apparatus of dynamic medical imaging of a subject comprising the steps of: obtaining a plurality of time separated images of the subject ("(7 min) MRI examination", Section 3.3 Image Registration, Page 215); registering the plurality of time separated images together to match corresponding locations in the images to each

other ("Registration is performed in 2-D only due to the sparse nature of the data. If 3-D data scans were performed, this algorithm can be expanded to 3-D", Section 3.3 Image Registration, Page 217); measuring from the registered images a temporal behaviour ("rise in the MR signal level when Gd-DTPA is injected into the bloodstream") of an imaged region ("breast") at a location in the subject ("patient", Section 3.3 Image Registration, Pages 215-217); and measuring a quality of the registration of the time separated images by: comparing the measured temporal behaviour with a model of expected temporal behaviour (" $M(x, y, t)$ is the model value at time t ") of the imaged region ("voxel (x, y) ") to calculate a level of agreement ("model residual images") between the measured temporal behaviour and the expected temporal behaviour, and determining a measure of the quality of registration of the time separated images from said calculated level of agreement, wherein said measure of the quality of registration indicates that registration quality is poorer when the calculated level of agreement between the measured temporal behaviour and the expected temporal behaviour is lower ("If the model fits were perfect this image would be totally black ... The post-registration image is evidently much improved over the pre-registration model residual image ... area exhibiting large residuals in the post-registration image is the top right-hand corner (Figure 16(b)). This is due to the motion of the heart.", Section 4 Results, Pages 218-219).

With respect to claims 14 and 16, it should be noted that the paper describes the implementation of an algorithm, which as known to a person of ordinary skill in the art is stored on a memory, and has been installed in the MRI centre of the John Radcliffe Hospital, Oxford, see Section 5 Conclusion, Page 220.

Re claim 2: Hayton et al. disclose obtaining the images involves the use of an imaging agent ("contrast agent") and said model is a model of the temporal behaviour of the imaging agent ("Figures A1 and A2 show that the impulse and steady bolus models both lead to very similar intensity rise functions.", Section 1 Introduction, Section 3 Using a Pharmacokinetic Model for MRI Analysis, and Appendix A Derivation of the Analytic Model Function, Pages 209, 213 and 222-224).

Re claim 3: Hayton et al. disclose the imaging agent is a contrast agent ("contrast agent", Appendix A Derivation of the Analytic Model Function, Pages 222-224).

Re claim 4: Hayton et al. disclose the level of agreement between the measured temporal behaviour and the expected temporal behaviour is displayed (Figures 16(a) and (b), Section 4 Results, Pages 218-219).

Re claim 5: Hayton et al. disclose the level of agreement is displayed overlaying an image of the subject (Figures 16(a) and (b), Section 4 Results, Pages 218-219).

Re claim 6: Hayton et al. disclose re-executing ("iteration scheme") the step of registering the plurality of time separated images together in imaged regions wherein the level of agreement is poor ("If images were perfectly registered, the mean square errors of the model fits would be minimized subject to the motion field being smooth over the image.", Section 3.4 Using the Pharmacokinetic Model for Image Registration, Section 4 Results, Pages 217-218).

Re claim 7: Hayton et al. disclose the registration process uses a parameterised process and is re-executed using different registration parameters (" $u(x, y)$, $v(x, y)$ ", Section 3.4 Using the Pharmacokinetic Model for Image Registration, Section 4 Results, Pages 217-218).

Re claim 11: Hayton et al. disclose the model is a temporal model of the take-up and wash-out of an imaging agent administered to the subject ("images are captured to plot the course of the contrast agent uptake by the tissues.", Section 1 Introduction, Appendix A Derivation of the Analytic Model Function, Pages 20- and 222-224).

Re claim 12: Hayton et al. disclose the subject is a living human ("women",
Section 1 Introduction, Page 207).

Re claim 13: Hayton et al. disclose the images are acquired by magnetic
resonance imaging ("breast MRI", Abstract, Page 207).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for
all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described
as set forth in section 102 of this title, if the differences between the subject matter sought to
be patented and the prior art are such that the subject matter as a whole would have been
obvious at the time the invention was made to a person having ordinary skill in the art to which
said subject matter pertains. Patentability shall not be negated by the manner in which the
invention was made.

5. Claims 8 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable
over Hayton et al. in view of Suri (U.S. Pat. No. 6,718,055). The teachings of
Hayton et al. have been discussed above.

As to claims 8 and 9, Hayton et al. does not explicitly disclose the
registration is re-executed at a different resolution/scale.

Suri teaches the registration is re-executed at a different resolution/scale
("down sampling or image size reduction", Col. 6 lines 26-41 and Col. 8 lines 13-
27).

Therefore, in view of Suri, it would have been obvious to one of ordinary
skill in the art at the time the invention was made to modify Hayton et al. by
incorporating the method step of re-executing the registration at different

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resolution/scale in order to find an optimized transformation between the temporally spaced images (Col. 6 lines 26-41).

6. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hayton et al. in view of Hossak et al. (U.S. Pat. No. 6,360,207). The teachings of Hayton et al. have been discussed above.

As to claim 10, Hayton et al. does not explicitly disclose the registration comprises searching through a search window defined in one of the images and the registration is re-executed using a different search window.

Hossak et al. teaches the registration comprises searching through a search window defined in one of the images ("block size to be search") and the registration is re-executed using a different search window ("The system adaptively changes the search area based on the previous motion estimate.", Col. 25 lines 40-67).

Therefore, in view of Hossak et al., it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Hayton et al. by incorporating the method step of adaptively changing the search area into a smaller or larger search area and re-execute the image registration in order to speed up the search for estimated motions and obtain a high degree of confidence when the detected motions exhibit little variation (Col. 25 lines 40-67).

Response to Arguments

Claim Rejections under 35 U.S.C. §103

7. Applicant's arguments, see Remarks, Pages 2-7, filed on March 25, 2008, with respect to the rejection(s) of claim(s) 1 under 35 U.S.C. §103 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of newly found prior art reference (See ***Claim Rejections - 35 USC § 102*** Section above).

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Boland et al. disclose a Method for Registering Images in a Radiographic Application, Zuo et al. disclose an Automatic Correction for Breast MR Imaging, and Pickens et al. disclose Digital Image Motion Correction by Warp Methods.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JOSE M. TORRES whose telephone number is (571)270-1356. The examiner can normally be reached on M-F: 8:00am - 4:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jingge Wu can be reached on 571-272-7429. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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JMT
04/08/2008

/Jingge Wu/

Supervisory Patent Examiner, Art Unit 2624